

**National Exposure Research Laboratory  
Research Abstract**

Government Performance Results Act (GPRA) Goal #4.5.2  
Annual Performance Measure #230

Significant Research Findings:

**Research to Support the National Children's Study**

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**Scientific  
Problem and  
Policy Issues**

To help understand how the environment affects children's health, a National Children's Study (NCS) is planned as authorized by the Children's Health Act (2000). The NCS is an interagency effort sponsored by the Department of Health and Human Services (DHHS) and the EPA. The goal of the NCS is to recruit and follow 100,000 children from birth to adulthood. A study of this size requires cost-effective methods that can measure large numbers of samples and provide results of the needed quality. The research described below was conducted to provide such methods to the NCS. The methods developed will also assist the EPA in meeting goals under the Food Quality Protection Act and other programs concerned with the effect of environmental contaminants on human health.

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**Research  
Approach**

EPA's National Exposure Research Laboratory (NERL) conducted several projects designed to develop or evaluate techniques for the NCS. Each project was reviewed annually by NCS staff. The project reports and publications have been subjected to the appropriate level of EPA and/or external peer review.

**Development of Exposure Assessment Study Designs**

The objective of this project was to develop cost-effective and optimally-designed statistical sampling strategies. When one is collecting detailed information about a small number of people and then using statistics to extrapolate this to a larger population, it is very important to know that you have sufficient numbers in the statistically selected population, those that represent the group of concern, for the statistics to accurately describe the larger population. To control costs, it is equally important that the small group not contain more people than needed.

**Demonstration of Low-Cost, Low-Burden, Exposure-Monitoring Methods**

The objective of this project was to develop and evaluate low-cost, low-burden methods for collecting high quality environmental and biological samples and survey information from study participants without the presence and/or assistance of field sampling technicians. Innovative sampling methods and approaches were developed for collecting the exposure and survey data. Pilot studies were conducted to evaluate how well participants managed to employ the methods and approaches and then complete these activities without direct contact from an investigator in the field.

**Methods Development**

The objective of this project was to identify, develop, and improve methods for classifying subjects by level of exposure to chemicals in order to focus resources

on the most highly exposed individuals. The approach included a literature search to identify potential sampling devices or methods, and laboratory studies to evaluate known methods of collecting long-term integrated air samples (semi-permeable membrane devices) and analytical methods for rapidly screening these samples for organophosphorus pesticides.

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**Results and  
Impact**

**Development of Exposure Assessment Study Designs**

Guidance and examples were provided for developing statistically valid designs for individual studies and to ensure that the studies collect the required data at minimum cost.

**Demonstration of Low-Cost, Low-Burden, Exposure-Monitoring Methods**

In the pilot studies, some types of samples (e.g., hair and vacuum cleaner dust) were successfully collected by over 90 percent of the participants. Other more complicated sampling procedures (e.g., collecting air samples) had a lower success rate. Participant compliance with sample-collection instructions was generally good. Follow-up interviews helped identify the weak points in the procedures and indicated areas where additional participant training would improve the success rate for sample collection. The results from these studies provide the NCS with low-cost alternatives to investigator-administered questionnaires and sample collection protocols. Recommendations for improving participant success in these procedures was also provided to the NCS.

**Methods Development**

Procedures for classifying exposure levels were developed.

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**Research  
Collaboration and  
Research  
Products**

NERL conducted the research with contract support from Research Triangle Institute and an interagency agreement with the U.S. Geological Survey.

The following publications describe the study design and results:

Fortmann, R. Demonstration of Low Cost, Low Burden, Exposure Monitoring Strategies for Use in Longitudinal Cohort Studies. Presented at: National Children's Pilot Study Review, Research Triangle Park, NC, November 21, 2003 and at the National Children's Study Assembly Meeting, Atlanta, GA, December 17, 2003.

Robertson, G.L., Hern, S.C., and Rogers, K.R. Methods studies for the national children's study: molecularly imprinted polymers. Presented at: National Children's Study Assembly Meeting, Atlanta, GA, December 17, 2003

Robertson, G.L., Hern, S.C., and Rogers, K.R. Methods studies for the national children's study: semipermeable membrane device (SPMD). Presented at: National Children's Study Assembly Meeting, Atlanta, GA, December 17, 2003.

McKinney, J.D., Hern, S.N., and Robertson, G.L. Identification of time-integrated sampling and measurement techniques to support human exposure studies. EPA 600/R-04/043.

Mishra, N.N., Pedersen, J.A., and Rogers, K.R. "Highly sensitive assay for anticholinesterase compounds using 96 well plate format." In: Chemicals in the Environment: Fate, Impacts, and Remediation, Chapter 16 M. L. Phillips (Ed.), Washington, DC: American Chemical Society 2001, 289-305.

Weetall, H., Mishra, N.N., Mahfouz, A., and Rogers, K.R. An approach for screening cholinesterase inhibitors in drinking water using an immobilized enzyme assay. *Analytical Letters*, 37,1297 - 1305 (2004).

Weetall, H., and Rogers, K.R. Preparation and characterization of molecularly imprinted electropolymerized carbon electrodes. *Talanta* 62 (1):329-335 (2004). EPA/600/J-04/040.

Rench, J.D. et al. Demonstration of Low Cost, Low Burden, Exposure Monitoring Strategies for Use in Longitudinal Cohort Studies - Final Report. U.S. EPA Report EPA/600/R-04/109. Office of Research and Development, Research Triangle Park, NC.

Strauss, W., Lehman, J., Morara, M., Ryan, L. (2003) Development of Exposure Assessment Study Design for the National Children's Study: . Prepared by Battelle Memorial Institute for USEPA National Exposure Research Laboratory, September 30, 2003.

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**Future Research**

Most of the specific research under this project has been completed. Work to determine the uptake rates for semi-permeable membrane devices is in progress and will be completed by September of 2005.

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**Contacts for  
Additional  
Information**

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